Field Preparation for High Level Control - Process Preview

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Summary and conclusion:

The introduction of a High-Level Control System requires a proper preparation of the plant to ensure an efficient and successful implementation and commissioning. For that purpose a so-called preproject from HMC is proposed in order to disclose eventual difficulties or even disability of the plant to implement such a system. A team of the Process Technology Department (HMC/PT) and Holderbank Engineering Switzerland (HES) will help the plant to achieve the best preparation.

HES will check the possibilities to connect the LINKman system to the installed plant control system and the sensitivity of measuring and control devices.

HMC/PT will check the quality aspects and the kiln behavior in order to disclose eventual process problems.

The main items of the LINKman preproject are:

- Kick-off meeting with explanation of the LINKman system and the procedure to implement it.
- Collection of all available plant data (Flow-sheets, technical descriptions of the installation).
- Collection of all available process data (Log-sheets, quality data, flow-sheets and trends).
- Combustion check.
- Description of the used strategy and rules for manual kiln and cooler control (which parameters were used) and a description of the most common kiln and cooler problems (dusty clinker, coating falls, etc.).
- Control of the adjustments of the most important control loops.
- Instrumentation check (type, position, sensitivity).
- Definition of the preparatory work to be done before the LINKman implementation.
- Conclusion meeting with the definition of the implementation schedule (ordering and commissioning). Definition of the project leader and of the responsible for the LINKman Hardware and Software (Strategy).

1. INTRODUCTION

The introduction of a kiln High-Level Control System like LINKman requires several preparatory works by the plant to ensure an efficient and successful implementation. The capability of the kiln to be driven by an automatic system has to be ensured by a pre-project. As in every project, the organization has to be determined and responsibles have to be nominated.

The LINKman pre-project has to cover mainly the following capability checks of the kiln system:

- Disclosing eventual process problems
- Defining an adequate kiln and cooler control strategy
- Checking the instrumentation
- Checking the sensitivity of the measuring and control devices (HES)
- Defining the connection of the LINKman system to the installed plant control system (HES).

2. DETAILED SCOPE OF WORK

2.1 Definition of responsibilities and meetings

A kick-off meeting has to be organized at the beginning of the pre-project. Experience has shown that a more detailed explication of the LINKman system avoids confusions. The implementation schedule (ordering and commissioning) has to be defined as well as the project leader and the responsibles for the LINKman Hardware and Software (Strategy).

The responsible for the Hardware issues is usually an electrical engineer with knowledge of the plant control system and the automatic control loops.

The responsible of the Software (strategy) needs detailed knowledge about the burning process and kiln control. Therefore, a process engineer is strongly recommended. He will be the future "LINKman – Champion" and doing all further modifications of the strategy after the commissioning.

Before the implementation also the exact position of the Hardware has to be defined (location of the operator- and engineer-station in the control room and location of the LINKman cabinet).

After finishing the study, all requirements will be discussed during the conclusion meeting at the end of the visit. The preparatory work has to be terminated until the first commissioning of ABB. If stronger process problems were detected, it may be recommended to postpone the order of the system.

2.2 Data collection

To prepare the system before delivering, ABB needs sufficient data about the plant. Therefore, a collection of all available plant data is required. This contains mainly:

Plant descriptions:

- Flow-sheet of the kiln system
- Flow-sheet of the plant control system (PLC-System)
- Kiln manufacturing data (see also Appendix 1)
- Layout of the control room (to place the Hardware and pre-configure the cabling)
- List of available control loops
- Instrumentation list.

Process data

- (During 1 week of representative production)
- Quality data of Raw meal, Hot meal and Clinker
- Operator log-sheets
- Statistical distribution of the freelime.

For 24 hours

- 1-day-trend of all important process values of that week (burning zone temperature, NOx, Amps, Calciner temperature, Preheater exit temperature, etc.)

Additional information

- Printout of all available kiln process screens (only 1 momentary printout)
- Short description of the used strategy and rules for manual kiln and cooler control (which parameters were used). Is there a correlation between the clinker quality and some kiln control parameters (NOx, kiln amps, burning zone temperature)?

2.3 Combustion check

Process problems strongly influence the kiln behavior. Incomplete combustion leads to enhanced Alkali/Sulfur cycles within the kiln system. If the molar Alkali/Sulfur ratio of the total input of Alkalis and Sulfur is within the desirable range (0.8 to 1.5), minor encrustation and Sulfur ring formation take place.

To avoid a bad or wrong implemented strategy and bad availability of the LINKman system, a combustion check is required.

A combustion check contains:

- Description and analysis of all fuel at the main firing
- Gas analysis data at kiln inlet (O_2, CO, NOx)
- Assessment of sintering zone, coating and the burner position
- Alkali/Sulfur balance. For this, sufficient samples of the raw meal, hot meal and clinker have to be taken and analyzed.
- Burner check (Primary air amount, fuel oil pressure, exit velocities, pressure fluctuations, etc.)
- Description and analysis of all fuels at the secondary firing
- Gas analysis data at preheater exit (O_2, CO, NOx)

2.4 Definition of the strategy

LINKman offers standard strategies for almost every kiln type. One of those strategies will be pre-configured before delivery and modified on site during the commissioning.

To ensure a proper predefinition of the kiln and cooler control strategy, a description of the current used strategy and the rules for manual kiln and cooler control is required.

Kiln Control:

Define the most important parameters estimating the burning zone temperature, the kiln inlet temperature and the oxygen level.

A description of the most common kiln problems (dusty clinker, coating falls, etc.) will help defining required special actions.

Cooler Control:

Define the most important parameters to ensure proper clinker cooling and high efficiency.

A description of the most common cooler problems (kiln rushes, red rivers, hot plates, etc.) will help defining required special actions.

2.5 Control loops

For a proper working High Level Control System, the in the PLC installed control loops have to work properly and smoothly. Therefore, the most important loops (kiln hood pressure control, under grate pressure control, etc.) have to be revised and adjusted, if required. A further possibility is the complete removing of a loop from the PLC in order to add it into the LINKman strategy or to switch it off during LINKman control.

2.6 Instrumentation check

The instrumentation is the most important point for an automatic kiln control. The signals have to be convenient and reliable. Therefore, the type and position of the most important sensors have to be revised and corrected if required. Especially the gas analyzers need periodic calibrations and maintenance inspections.

For a list with required process signals and its position see Report HES 98/6347/E.

3. APPENDIX 1

3.1 KILN MANUFACTURING DATA

Plant

Kiln	No. :	.....
	Supplier:	.....
	Nominal Capacity:	..... (t/d)
	Max. Capacity:	..... (t/d)
	Type of fuels :	.....
		.....
		.....
		.....
		.....
		.....
	Heat Consumption:	..... (kJ/kg)
	Length:	..... (m)
	Diameter:	..... (m)
	Slope:	..... (%)
Preheater:	Number of strings:	.....
	Number of stages:	.....
Precalciner:	Type:	.....
	Type of fuels:	.....
		.....
		.....
		.....
		.....
	% Fuel PC / Kiln:	.....
Burner	Type:	.....
	% Primary air:	.....
Cooler	Type:	.....
	Number of grates:	.....
	Number of fans:	.....
	Width x length:	.....